TITLE: METHOD OF THERMAL INSULATION OF A POOL

Field of the Invention

This invention relates to a method of thermal insulation of a pool, in particular to a method of thermal insulation of a swimming pool, and to a pool that is thermally insulated by such a method.

Background to the Invention

Various methods of thermal insulation of pools are known.

In one of the known methods, hollow modular expanded polystyrene formers sold under the registered trade mark BECO are assembled into a pool wall and concrete is poured into the formers. Once the concrete has set, the formers are left in place to give a concrete pool wall the interior and exterior surfaces of which are provided with a layer of expanded polystyrene.

This method is not suitable for construction of a floor of a pool and can only be used for construction of the walls of new pools.

In another of the known methods, shown in International Patent Application Publication No. WO 01/44601, modular wall members comprising a pair of steel sheets enclosing a layer of polyurethane insulation are assembled into a pool wall inside a hole. The modular wall members are braced against the edges of the hole by brace rods so as to leave a gap between the edges of the hole and the exterior surface of the pool wall. The gap is then filled with a suitable backfill material such as pea shingle.

Again this method is not suitable for construction of a floor of a pool and can only be used for the construction of the walls of new pools.

In yet another of the known methods, a hole is excavated and a steel skeleton is erected against the walls of the hole. Insulation boards are attached to the steel skeleton to line the walls of the hole. Cement is then sprayed onto the insulation board and floor of the hole in layers to form a pool wall and floor.

This method is also not suitable for construction of a floor of a pool, because the weight of the pool would have to be supported on insulation board. It also can be used only for the construction of new pools.

In this specification, "pool" includes any container that will hold more than 200 litres of a liquid, for example a swimming pool, exercise pool, or a hot tub.

Summary of the Invention

According to a first aspect of the invention there is provided a method of thermal insulation of a pool, the method comprising the steps of preparing a pool structure, and attaching a layer of thermal insulation material to an interior surface of the pool structure.

The step of preparing the pool structure may advantageously comprise building a new pool structure.

However, the step of preparing the pool structure may advantageously alternatively comprise preparing an existing pool structure, to enable the layer of thermal insulation material to be attached thereto.

The invention therefore provides a method that is more versatile than known methods, because it can be carried out on both new and existing pools, and can be used on both the walls and the floors of such pools.

Where the step of preparing the pool structure comprises building a new pool structure, the step of building the new pool structure may advantageously include attaching a further

layer of thermal insulation material, said further layer being attached to an exterior surface of the pool structure.

In this way not only can heat transfer from a liquid in the pool to the pool structure be reduced, but also heat transfer from the pool structure to the environment of the pool structure can be reduced.

The step of preparing the existing pool structure may advantageously simply comprise draining the existing pool structure.

Preferably, however, the step of preparing the existing pool structure comprises draining the existing pool structure and preparing an interior surface of the existing pool structure for attachment of the layer of thermal insulation material.

The step of attaching the layer of thermal insulation material to the interior surface of the pool structure may advantageously comprise applying an adhesive to the layer and/or to the surface.

Alternatively or additionally, the step of attaching the layer of thermal insulation material to the interior surface of the pool structure may advantageously comprise fastening the layer of thermal insulation to the surface by means of a mechanical fastener.

The layer of thermal insulation material may advantageously comprise an impermeable material. Use of an impermeable material prevents a liquid in the pool from being absorbed into the material, which would adversely affect the thermal insulation property of the material.

The layer of thermal insulation material preferably comprises at least one insulation board.

Where the layer of thermal insulation material comprises at least one insulation board, the at least one insulation board is preferably coated on all of its surfaces with a sealant layer.

The sealant layer prevents a liquid in the pool from being absorbed into the insulation board. This is important because if a liquid is absorbed into the board and then freezes, it can damage the structure of the board. Also, the insulation board insulates by maintaining an air gap between a liquid in the pool and the environment of the pool structure. If the liquid is absorbed into the insulation board, the air gap is, in effect, removed from between the liquid and the environment of the pool structure.

Preferably the at least one insulation board is a phenolic insulation board, and more preferably still, a cellular glass insulation board, such as is sold under the registered trade mark FOAMGLAS.

The step of attaching the layer of thermal insulation material to the internal surface of the pool structure may advantageously comprise attaching the layer to at least one of a wall or walls and a floor of the pool structure.

Preferably the step of attaching the layer of thermal insulation material to the internal surface of the pool structure comprises attaching the layer to both the wall or walls and the floor of the pool structure.

Where the layer of thermal insulation material is attached to both the wall or walls and the floor of the pool structure, the layer is preferably continuous.

The invention therefore further provides a method that is more effective than known methods, because heat transfer from a liquid in the pool to both the wall or walls and floor of the pool structure is reduced.

The method preferably comprises the further step of applying a finish to the layer of thermal insulation material and said further step may advantageously comprise tiling the layer.

Alternatively, the step of applying the finish may advantageously comprise laying a waterproof liner over the layer.

Where a waterproof liner is laid over the layer of thermal insulation material, the layer is preferably provided with apertures arranged to permit a liquid between the liner and the layer to escape from the pool structure.

This is useful where a liquid in the pool is splashed over the top edge of the waterproof liner and flows between the exterior surface of the liner and the layer of thermal insulation material.

Where the layer of thermal insulation material comprises a plurality of insulation boards and all of the surfaces of the insulation boards are coated with a sealant layer, the method may advantageously include the step of sliding the edges of neighbouring boards against one another so as to trap a sealant layer between the edges of the plurality of boards.

In this way the need to use a liner or to apply a waterproof render to the insulation boards to retain a liquid in the pool can be avoided, because the insulation boards themselves form a liner.

The method may advantageously further comprise the step of bevelling the upper edges of the layer of thermal insulation material attached to the wall or walls of the pool structure and/or the edges of an aperture formed in the layer of thermal insulation material.

In this way, a waterproof liner laid over the layer of thermal insulation material does not have to be laid over any sharp edges that would otherwise be present at the upper edges of the layer of thermal insulation material attached to the wall or walls of the pool structure and/or the edges of any apertures formed in the layer. In addition, the bevelling makes it easier to stretch the liner to fit the pool structure without tearing the liner.

Preferably the pool is a swimming pool.

According to a second aspect of the invention there is provided a pool constructed according to the method of the first aspect of the invention.

Preferably the pool is a swimming pool.

According to a third aspect of the invention there is provided a pool comprising a pool structure and a layer of thermal insulation material attached to an interior surface of a floor of the pool structure.

Preferably the pool further comprises a layer of thermal insulation material attached to an interior surface of a wall or walls of the pool structure.

Preferably the pool is a swimming pool.

Brief Description of the Drawing Figures

The invention will now be described by way of illustrative example and with reference to the accompanying drawing figures in which:

Figure 1 is a sectional view of a portion of a wall of a first swimming pool in accordance with the second aspect of the invention;

Figure 2 is a sectional view of a portion of a wall of a second swimming pool in accordance with the second aspect of the invention;

Figure 3 is a sectional view of a portion of a wall of a third swimming pool in accordance with the second aspect of the invention;

Figure 4 is a sectional view of a filter inlet (through which water flows from the pool to a filter) in a wall of the swimming pool of Figure 3; and

Figure 5 is a sectional view of a filter outlet (through which water flows from a filter to the pool) in a floor of the swimming pool of Figure 3.

Detailed Description of Embodiments

A first swimming pool 100 is built by excavating a rectangular hole in the earth and lining the hole with a wire mesh screen to restrain the earthen banks that form the walls of the hole. One such bank is shown in Figure 1, denoted by reference numeral 9. The wire mesh screen is not shown in Figure 1.

Gunnite is sprayed in layers against the banks and wire mesh screen and the floor of the hole to a thickness of 350mm, to form the walls and floor of the pool structure. One such wall is shown in Figure 1, denoted by reference numeral 10.

As shown in Figure 1, a coating 14 of S-2625 E epoxy adhesive, available from Structural Adhesives Limited of Leicester, UK, is applied to the walls 10 and floor and 80mm thickness phenolic insulation boards 11 are attached to the walls 10 and floor of the pool structure.

The attachment of the phenolic insulation boards 11 to the walls 10 and floor is strengthened by means of Termofix S8 110mm length hammerset fixings, available from Knauf Marmorit GmbH of Germany. Such a fixing is shown in Figure 1, denoted by reference numeral 15.

A finish in the form of a coating 12 of between 5 and 10mm thickness of MR ST1 composite mortar is applied to the phenolic insulation boards 11 and MR scrim is embedded in the coating 12. The scrim is not shown in Figure 1. Both the composite mortar and scrim are available from Alumsac Exteriors Building Products Limited of Merseyside, UK. The attachment of the coating 12 to the phenolic insulation boards 11 is strengthened by means of Termofix S8 110 mm length hammerset fixings. Another such fixing is shown in Figure 1 passing through the coating 12, and is also denoted by reference numeral 15.

A render 13 of waterproofed sand and cement is applied to the coat 12 of composite mortar. Two coats of pool paint are applied to the render 13, and once dry, the pool structure is filled with water, denoted in Figure 1 by reference numeral 17.

Turning to Figure 2, a second swimming pool 200 is also built by excavating a rectangular hole, lining the hole with a wire mesh screen, spraying gunnite against the banks and floor of the hole and applying a coating of epoxy adhesive to the walls and floor formed by the gunnite as described in relation to Figure 1, and these components (where shown) are denoted by the same reference numerals in Figure 2 as in Figure 1.

Phenolic insulation boards 18 of 80mm thickness are attached to the walls and floor of the pool structure and the attachment of the phenolic insulation boards 18 to the walls 10 and floor is strengthened as described above in relation to Figure 1 by hammerset fixings 15.

A polyvinyl chloride (PVC) liner 19 is laid over the phenolic insulation boards 18 and the pool structure filled with water 17.

Turning to Figure 3, this shows a third swimming pool 300 that is built by excavating a rectangular hole and lining the earthen banks 9 of the hole with walls 20 constructed of breeze blocks 22. A concrete floor is laid upon suitable foundations formed in the bottom of the hole.

Cellular glass insulation boards 24 are coated on a first face and their edges with a layer 26 of S-2625 E epoxy adhesive. The layer 26 of epoxy adhesive on the first face of each board is used to attach the boards to the walls 20 and floor of the pool structure. To attach each board to the wall or floor the board is placed against the wall or floor and then slid relative to the wall or floor to abut one or more neighbouring boards, so that a layer of epoxy adhesive is trapped between the edges of each board and its neighbouring boards.

The second, opposite faces of the boards are levelled and a layer 28 of epoxy adhesive is applied to the opposite faces of the boards so as to form an even surface. In this way, the boards 24 form a continuous surface over the walls 20 and floor of the pool structure.

Coating all of the surfaces of the boards with epoxy adhesive prevents water from entering the boards. This is important for two reasons, namely that water entering the cells at the surfaces of the cellular glass boards would freeze in winter and destroy those cells, eventually breaking down the structure of the cellular glass boards, and if absorbent insulation boards were used instead of cellular glass boards, for example phenolic insulation boards, in the absence of the coating the boards would become waterlogged and lose their thermal insulation property, acting as thermal bridges between the water in the pool and the environment of the pool structure.

A coating 30 of a waterproof sealant is applied to the sealed even surface formed by the levelled boards 24. Tiles 32 are attached to the coating 30 using a mixture of grout and a waterproof adhesive. Instead of tiling, it is possible to lay a PVC liner (not shown in Figure 3) over the coating 30.

Where an existing pool is to be insulated by the method of the invention, the tiling of the existing pool is removed and sealed cellular glass insulation boards are bonded to the existing pool structure beneath the tiling using a layer of S-2625 E epoxy adhesive as described above in relation to Figure 3. If a suitable adhesive can be found for use instead of S-2625 epoxy adhesive, it may be possible to bond the sealed cellular glass insulation boards to the tiling itself, thus avoiding the need to remove the tiling of the existing pool.

Where an existing pool has a PVC liner and is to be insulated by the method of the invention, the PVC liner is removed and sealed cellular glass insulation boards are bonded to the existing pool structure beneath the PVC liner as described in relation to Figure 3. The steps described above of trapping a layer of epoxy adhesive between the cellular glass insulation boards, levelling the exposed second faces of the boards, applying the layer 28 of epoxy adhesive and applying the coating 30 of waterproof sealant to the sealed even

surface remove the need for the PVC liner. Nevertheless, if it is not wished to tile over the insulation boards, a PVC liner may instead be laid over the boards. In that case it is desirable to provide small drainage holes in the boards 24 at the corners and along the lower edges of the wall 20, at intervals of one to two metres, to enable water between the boards and the liner to escape from the pool structure.

Turning finally to Figures 4 and 5, these show bevelling of the edges of the cellular glass insulation boards 24 where apertures have been formed in the boards to permit water 17 to flow, respectively, between the pool and a filter inlet 38 and a filter outlet 40. The bevelling, in addition to being more aesthetically pleasing and safer than an abrupt edge to the insulation boards, ensures that a PVC liner, if used, is not subjected to a sharp edge, which might tear the liner. If tiling is used instead of a PVC liner, as shown in Figure 3, the tiles would be laid to follow the bevelled edges of the insulation boards, so as to avoid subjecting users of the swimming pool to sharp edges.

It is desirable when building the pool structure to recess fittings such as the filter inlet 38 and filter outlet 40 less deeply into the pool structure than would be the case with a conventional pool, because once the insulation boards 24 have been fitted to the pool structure, such fittings are, in effect, recessed by the thickness of the insulation boards.

It is believed that the method of thermal insulation of the invention is more effective than known methods because, if used on both the wall or walls and floor of a swimming pool, heat transfer between water in the pool and the pool structure is very much reduced and any thermal bridge between the water in the pool and the environment surrounding the pool structure, be it air or earth, is very much reduced. Pools insulated using the known methods can at best reduce only the thermal bridge between the water in the pool and the walls of the pool structure, not the thermal bridge between the water and the floor of the pool structure, which conducts heat directly into the earth beneath the pool structure.

It is estimated that, while it is possible using known methods of thermal insulation to reduce heat transfer through a pool structure to the environment by up to 40 percent, using

the method of the invention with cellular glass insulating boards of 100 mm thickness on a pool of 10 m length, 5 m width and 1.5 m depth, it is possible to reduce heat transfer through a pool structure to the environment by 80 percent or more.

It will be apparent that the above description relates only to three embodiments of the invention, and that the invention encompasses other embodiments as defined by the claims set out hereafter. In particular, it will be apparent to those skilled in the art that the method of the invention can be carried out on pools made of materials, and made in shapes, other than those mentioned in relation to the three embodiments described above using materials other than those mentioned above. The method can also be carried out on pools that are constructed above ground level, as opposed to constructed in holes excavated in the earth.